

REMARKS

At the time the present Office Action was mailed, claims 1-36 were pending in this application. Claims 19, 21 and 23-25 have been cancelled from the application in this response, without prejudice, and without commenting on or conceding the merits of the outstanding rejections. Claims 1, 3, 10, 12, 17, 18, 20 and 22 have been amended in this response. Accordingly, claims 1-18, 20, 22 and 26-36 are currently pending in the application. Claims 26-36 have not been amended, and therefore, any rejection in a subsequent Office Action based on a new reference should not be made final.

In the Office Action mailed September 12, 2002, claims 1-36 were rejected. More specifically, the status of the application in light of this Office Action is as follows:

(A) Claims 1, 2, 4-6, 10, 12-14 and 16 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,432,840 to Hembree ("Hembree");

(B) Claims 17 and 19-27 were rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,424,031 to Glenn ("Glenn");

(C) Claim 15 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Hembree;

(D) Claims 3, 7-9 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hembree in view of U.S. Patent No. 6,433,419 to Khandros et al. ("Khandros");

(E) Claims 18 and 28-31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Glenn in view of Khandros; and

(F) Claims 32-36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Glenn and Khandros in view of U.S. Patent No. 6,093,969 to Lin ("Lin").

Applicant's attorney wishes to thank the Examiner and the Examiner's supervisor for engaging in a telephone conference on December 11, 2002. During that telephone

conference, the present Office Action, the proposed claim amendments, and the pending claims were discussed. The following remarks summarize and expand upon the points discussed in the December 11th telephone conference.

A. Response to the Section 102(e) Rejection Over Hembree

Claims 1, 2, 4-6, 10, 12-14 and 16 were rejected under 35 U.S.C. § 102(e) as being anticipated by Hembree.

1. Claim 1 is Directed to a Method for Packaging a Microelectronic Substrate Including Removing a Portion of the Encapsulating Material in Direct Contact With the Microelectronic Substrate

Claim 1 is directed to a method for packaging a microelectronic substrate including disposing an encapsulating material in direct contact with a surface of the microelectronic substrate. The method further includes exposing at least a portion of the surface of the microelectronic substrate by removing a portion of the encapsulating material in direct contact with the surface of the microelectronic substrate. The microelectronic substrate is in an operable condition after the portion of the encapsulating material is removed. An advantage of the method in accordance with claim 1 is that removing a portion of the encapsulating material allows heat to be more effectively and efficiently removed from the microelectronic substrate.

2. Hembree Discloses a Method for Forming a Thermally Enhanced Semiconductor Device

Hembree discloses a method for forming a thermally enhanced semiconductor device. "A layer or coupon of thermally conductive filled gel elastomeric layer material . . . is applied as a solid or semisolid to the back side of the semiconductor die, either before or (preferably) after the semiconductor die is electrically down bonded to the substrate. The gel elastomer layer masks the back side from glob top material which may be inadvertently misapplied to the back side." (Column 7, lines 50-58.) Next, the glob top material is applied "to encapsulate and seal the semiconductor die and portions of the adjacent substrate upper surface." (Column 7, lines 63-65.) Some of the glob top material can be misapplied to the gel elastomer layer. Accordingly, "the

gel elastomer layer is then removed, e.g. by peeling it back from the back side of the semiconductor die" to remove the top glob material. (Column 8, lines 8-10.)

3. Hembree Fails to Disclose Removing a Portion of the Encapsulating Material in Direct Contact with the Surface of the Microelectronic Substrate

Hembree fails to disclose a method for packaging a microelectronic substrate including, *inter alia*, "removing a portion of the encapsulating material in direct contact with the surface of the microelectronic substrate," as recited in claim 1. For example, Hembree discloses a method of removing glob top material that was misapplied to a gel elastomeric layer that is in contact with the semiconductor die. Assuming for the sake of argument that Hembree's glob top material corresponds at least in part to the encapsulating material of claim 1, the glob top material is not "in direct contact with the surface of the microelectronic substrate," as recited in claim 1. Alternatively, Hembree's gel elastomeric layer cannot correspond to the encapsulating material of claim 1 because it does not provide encapsulating functionality. Consequently, Hembree fails to disclose each and every element of claim 1. Therefore, the Section 102(e) rejection of claim 1 is improper and should be withdrawn.

Claims 2 and 4-6 depend from claim 1. Accordingly, the Section 102(e) rejection of these claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

4. Claim 10 is Directed to a Method for Packaging a Microelectronic Substrate Including Manipulating a Portion of the Encapsulating Material in Direct Contact With the Microelectronic Substrate

Claim 10 is directed to a method for packaging a microelectronic substrate including disposing an encapsulating material in direct contact with the microelectronic substrate. The method further includes forming a heat transfer structure in an external surface of the encapsulating material by manipulating at least a portion of the encapsulating material in direct contact with the microelectronic substrate to define at least one exposed heat transfer surface of the heat transfer structure. An advantage of the method in accordance with claim 10 is that manipulating a portion of the

encapsulating material to define a heat transfer surface allows heat to be more effectively and efficiently removed from the microelectronic substrate.

5. Hembree Fails to Disclose Manipulating a Portion of the Encapsulating Material in Direct Contact With the Microelectronic Substrate

Hembree fails to disclose a method for packaging a microelectronic substrate including, *inter alia*, "manipulating at least a portion of the encapsulating material in direct contact with the microelectronic substrate to define at least one exposed heat transfer surface," as recited by claim 10. As discussed above, Hembree discloses a method of removing glob top material that was misapplied to the gel elastomeric layer that is in contact with the semiconductor die. Assuming for the sake of argument that Hembree's glob top material corresponds at least in part to the encapsulating material of claim 10, the glob top material is not "in direct contact with the microelectronic substrate," as recited in claim 1. Alternatively, Hembree's gel elastomeric layer cannot correspond to the encapsulating material of claim 10 because it does not provide encapsulating functionality. Consequently, Hembree fails to disclose each and every element of claim 10. Therefore, the Section 102(e) rejection of claim 10 is improper and should be withdrawn.

Claims 12-14 and 16 depend from claim 10. Accordingly, the Section 102(e) rejection of these claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

B. Response to the Section 102(e) Rejection Over Glenn

Claims 17 and 19-27 were rejected under 35 U.S.C. § 102(e) as being anticipated by Glenn.

1. Claim 17 is Directed to a Method for Packaging a Microelectronic Substrate Including Processing the Support Member to Have an Interlocking Feature by Manipulating a Portion of the Support Member

Claim 17 is directed to a method for packaging a microelectronic substrate including positioning at least one of an encapsulating material and a support member

adjacent to the microelectronic substrate. The method further includes processing the support member to have an interlocking feature by manipulating a portion of the support member. The interlocking feature is configured to engage with a corresponding interlocking feature of another microelectronic substrate package. An advantage of the method in accordance with claim 17 is that processing the support member to have an interlocking feature provides greater assurance that if microelectronic substrates are stacked, they will be properly aligned.

2. Glenn Discloses a Stackable Package Including a Key Extending Into the Molded Plastic Package Body

Glenn discloses a stackable package that contains an electronic device, such as a flip chip integrated circuit. The flip chip is embedded in a package body, "which is formed of a molded insulative encapsulant material, such as a transfer molded or injection molded plastic material." (Column 2, lines 59-62.) A pair of "keys protrude from the first side of the package body." (Column 3, lines 43-44.) The "[k]eys are formed of the encapsulant material that forms package body." (Column 3, lines 46-48.) A pair of apertures "denoted as keyholes are formed in the second side of the package body." (Column 3, lines 48-50.) "Keys and keyholes have reciprocal shapes, so that keys of one package will fit into the keyholes of another package stacked with the first package." (Column 3, lines 52-55.)

3. Glenn Fails to Disclose Processing the Support Member to Have an Interlocking Feature by Manipulating a Portion of the Support Member

Glenn fails to disclose a method for packaging a microelectronic substrate including, *inter alia*, "processing the support member to have an interlocking feature by manipulating a portion of the support member," as recited in claim 17. For example, if one assumes that the package body of Glenn's device corresponds in part to the encapsulating material recited in claim 17, Glenn discloses forming an interlocking feature in the encapsulating material and not the support member. Consequently, Glenn fails to disclose each and every element of claim 17. Therefore, the Section 102(e) rejection of claim 17 is improper and should be withdrawn.

Claims 19, 21 and 23-25 have been cancelled and therefore these rejections are now moot.

Claims 20 and 22 depend from claim 17. Accordingly, the Section 102(e) rejection of these claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

4. Claim 26 is Directed to a Method for Packaging a Microelectronic Substrate Including Removing a Portion of the Encapsulating Material Covering the Bond Pad to Expose the Bond Pad

Claim 26 is directed to a method for packaging a microelectronic substrate including electrically coupling the microelectronic substrate to a support member having a first surface and a second surface facing opposite the first surface. The first surface has a conductive bond pad. The method further includes positioning the support member and the microelectronic substrate between two portions of a mold with the first surface and the bond pad of the support member facing a first cavity in the first portion of the mold and the microelectronic substrate facing a second cavity in the second portion of the mold. The method further includes disposing an encapsulating material in the first and second cavities of the mold to engage the microelectronic substrate and the bond pad, and removing a portion of the encapsulating material covering the bond pad to expose the bond pad while the microelectronic substrate remains in an operable condition. An advantage of the method in accordance with claim 26 is that support member can be clamped uniformly from above and below.

5. Glenn Fails to Disclose Removing a Portion of the Encapsulating Material Covering the Bond Pad to Expose the Bond Pad

Glenn fails to disclose a method for packaging a microelectronic substrate including, *inter alia*, "removing a portion of the encapsulating material covering the bond pad to expose the bond pad," as recited in claim 26. For example, if one assumes that the lead and package body of Glenn's device correspond in part to the bond pad and encapsulating material, respectively, recited in claim 26, Glenn fails to disclose "removing a portion of the encapsulating material covering the bond pad to expose the bond pad." Consequently, Glenn fails to disclose each and every element

of claim 26. Therefore, the Section 102(e) rejection of claim 26 is improper and should be withdrawn.

Claim 27 depends from claim 26. Accordingly, the Section 102(e) rejection of this claim should be withdrawn for the reasons discussed above and for the additional features of this claim.

C. Response to the Section 103(a) Rejection Over Hembree

Claim 15 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Hembree. Hembree and the claimed invention were, at the time the invention was made, subject to an obligation of assignment to Micron Technology, Inc. Accordingly, Hembree cannot be used as a reference to support a Section 103(a) rejection of the claimed invention.

D. Response to the Section 103(a) Rejection Over Hembree and Khandros

Claims 3, 7-9 and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hembree in view of Khandros. As discussed above, Hembree cannot be used to support a Section 103(a) rejection of the claimed invention. As discussed in detail below, the Khandros reference alone does not support the Section 103(a) rejection of claims 3, 7-9 and 11.

1. Khandros Discloses a Face-up Semiconductor Chip Assembly

Khandros discloses a semiconductor chip assembly including a substrate 20 having a top surface 22 and contact pads 24 disposed on the top surface 22. (Column 10, lines 24-26.) A chip 28 is mounted to the top surface 22 of the substrate 20 in a face down orientation with a dielectric interposer 42 disposed between the chip 28 and the substrate 20. (Column 10, lines 48-52.) The interposer 42 has terminals 48 that are electrically coupled to the contacts 40 on the chip 28 by leads 50 that pass through apertures 54 in the interposer 42. (Column 10, lines 57-60.) The assembly can include an encapsulant filling apertures in the interposer and covering the leads. (Column 15-16, lines 65-1.) Alternatively, the encapsulant may be deposited over the entire interposer 42, including the terminals 48. (Column 16, lines 7-8.) Holes may be

formed in the encapsulant over the terminals 48 using laser light. (Column 16, lines 14-16.)

2. Khandros Fails to Disclose a Method for Packaging a Microelectronic Substrate

Khandros fails to disclose a method for packaging a microelectronic substrate including, *inter alia*, "disposing an encapsulating material in direct contact with a surface of the microelectronic substrate," and "exposing at least a portion of the surface of the microelectronic substrate by removing a portion of the encapsulating material in direct contact with the surface of the microelectronic substrate," as recited by claims 3 and 7-9. Nor does Khandros provide any motivation for modifying his method to include the above-mentioned features. Accordingly, the Section 103(a) rejection of claims 3 and 7-9 should be withdrawn.

Khandros fails to disclose a method for packaging a microelectronic substrate including, *inter alia*, "disposing an encapsulating material in direct contact with the microelectronic substrate," and "forming a heat transfer structure in an external surface of the encapsulating material by manipulating at least a portion of the encapsulating material in direct contact with the microelectronic substrate to define at least one exposed heat transfer surface of the heat transfer structure," as recited by claim 11. Nor does Khandros provide any motivation for modifying his method to include the above-mentioned features. Accordingly, the Section 103(a) rejection of claim 11 should be withdrawn.

E. Response to the Section 103(a) Rejection Over Glenn in View of Khandros

Claims 18 and 28-31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Glenn in view of Khandros. Claim 18 (which depends from claim 17) and claims 28-31 (which depend from claim 26) are patentable over the applied references for the reasons discussed above with reference to claims 17 and 26 and for the additional features of these claims. Furthermore, Khandros fails to cure the above-

noted deficiencies of Glenn, and accordingly these references together fail to support a rejection under 35 U.S.C. § 103(a).

1. The Combination of Glenn and Khandros Fails to Disclose all the Features of Claim 18

The combination of Glenn and Khandros fails to disclose, *inter alia*, “processing the support member to have an interlocking feature by manipulating a portion of the support member,” as recited in claim 18. As discussed above, Glen discloses forming interlocking features in the encapsulating material and not the support member. Khandros provides no motivation for modifying Glenn’s method to “[process] the support member to have an interlocking feature by manipulating a portion of the support member.” Accordingly, the Section 103(a) rejection of claim 18 should be withdrawn.

2. There Is No Motivation to Combine Glenn and Khandros

The Office Action fails to provide a motivation for combining Khandros and Glenn to cure the above-noted deficiencies of Glenn regarding claim 26. For example, the Office Action fails to provide a motivation for modifying Glenn’s method to include “removing a portion of the encapsulating material covering the bond pad to expose the bond pad,” as recited in claim 26. If one assumes that the lead and package body in Glenn’s device correspond in part to the bond pad and encapsulating material, respectively, recited in claim 26, there is no motivation to remove a portion of the package body covering the lead to expose the lead since the lead is already exposed for connection (see Figure 2). Alternatively, if one assumes that the bond pad and package body in Glenn’s device correspond in part to the bond pad and encapsulating material, respectively, recited in claim 26, there is no motivation for removing at least a portion of the package body from the bond pads since the bond pads are in intimate contact with the leads and not covered by the package body. Accordingly, there is no motivation for curing the above-noted deficiency of Glenn. Therefore, the Section 103(a) rejection of claims 28-31 (which depend from claim 26) should be withdrawn.

F. Response to the Section 103(a) Rejection Over Glenn and Khandros in View of Lin

Claims 32-36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Glenn and Khandros in view of Lin.

1. Claim 32 is Directed to a Method for Packaging a Microelectronic Substrate Including Encapsulating the Substrate and Directing a Source of Laser Radiation to Remove a Portion of the Encapsulating Material

Claim 32 is directed to a method for packaging a microelectronic substrate including mounting the microelectronic substrate to a support member with a first surface of the microelectronic substrate facing the support member and a second surface of the microelectronic substrate facing opposite the first surface. The method further includes electrically coupling the microelectronic substrate to the support member by passing wire bonds through an aperture in the support member and connecting one end of each wire bond to the support member and an opposite end of each wire bond to the microelectronic substrate. The method further includes encapsulating the microelectronic substrate and the support member by disposing an encapsulating material over the support member and the second surface of the microelectronic substrate, and directing a source of laser radiation toward the second surface of the microelectronic substrate to remove at least a portion of the encapsulating material adjacent to the second surface and expose the second surface.

2. The Applied References Fail to Disclose or Suggest all of the Elements of Claim 32

The applied references fail to disclose, *inter alia*, “encapsulating the microelectronic substrate and the support member by disposing an encapsulating material over the support member and the second surface of the microelectronic substrate,” and “directing a source of laser radiation toward the second surface of the microelectronic substrate to remove at least a portion of the encapsulating material adjacent to the second surface and expose the second surface,” as recited in claim 32. For example, if one assumes that the electronic device and leads in Glenn's device correspond in part to the microelectronic substrate and support member, respectively,

recited in claim 32, Glenn's method fails to disclose, *inter alia*, "disposing an encapsulating material over the support member and the second surface of the microelectronic substrate." Khandros and Lin also fail to disclose, *inter alia*, the above-mentioned feature. Furthermore, none of the applied references provide any motivation for modifying their methods to include the above-mentioned feature. Accordingly, the Section 103(a) rejection of claim 32 should be withdrawn.

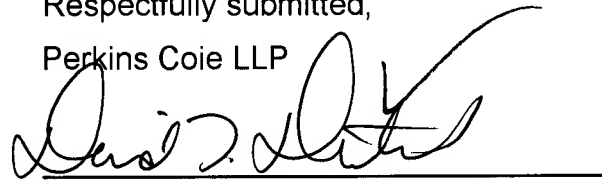
Claims 33-36 depend from claim 32. Accordingly, the Section 103(a) rejection of these claims should be withdrawn for the reasons discussed above and for the additional features of these claims.

G. Conclusion

In light of the foregoing amendments and remarks, all of the pending claims are in condition for allowance. Applicant, therefore, requests reconsideration of the application and an allowance of all pending claims. If the Examiner wishes to discuss the above-noted distinctions between the claims and the cited references, or any other distinctions, the Examiner is encouraged to contact David Dutcher by telephone. Additionally, if the Examiner notices any informalities in the claims, he is also encouraged to contact David Dutcher to expediently correct any such informalities.

Date: 12/12/02

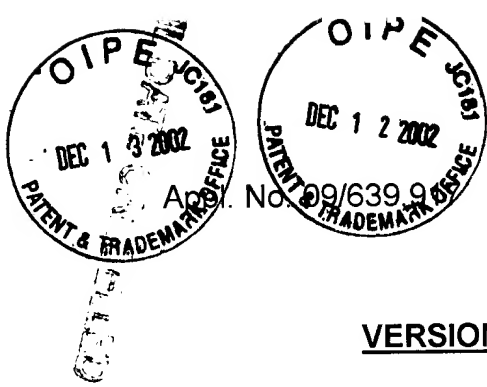
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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

1. (Amended) A method for packaging a microelectronic substrate, comprising:

disposing an encapsulating material adjacent to in direct contact with a surface of the microelectronic substrate; and

exposing at least a portion of the surface of the microelectronic substrate by removing a portion of the encapsulating material adjacent to in direct contact with the surface of the microelectronic substrate with the microelectronic substrate in an operable condition after the portion of the encapsulating material is removed.

3. (Amended) The method of claim 1, further comprising:

mounting the microelectronic substrate to a support member with a first surface of the microelectronic substrate facing the support member and a second surface of the microelectronic substrate facing away from the support member;

electrically coupling the microelectronic substrate to the support member;

disposing the encapsulating material adjacent to both the microelectronic substrate and the support member; and

exposing at least a portion of the second surface of the microelectronic substrate by directing laser radiation toward the portion of the encapsulating material adjacent to in direct contact with the second surface to ablate the portion of the encapsulating material.

10. (Amended) A method for packaging a microelectronic substrate, comprising:

disposing an encapsulating material adjacent to in direct contact with the microelectronic substrate; and

forming a heat transfer structure in an external surface of the encapsulating material by manipulating at least a portion of the encapsulating material in direct contact with the microelectronic substrate to define at least one exposed heat transfer surface of the heat transfer structure.

12. (Amended) The method of claim 10 wherein the microelectronic substrate has a first surface and a second surface facing opposite the first surface, the first surface having a plurality of bond sites for electrical connections to the microelectronic substrate, and further wherein manipulating at least a portion of the encapsulating material includes removing a portion of the encapsulating material ~~adjacent to~~ in direct contact with the second surface of the microelectronic substrate.

17. (Amended) A method for packaging a microelectronic substrate, comprising:

positioning at least one of an encapsulating material and a support member adjacent to the microelectronic substrate; and

processing ~~at least one of the encapsulating material and the support member~~ to have an interlocking feature by manipulating a portion of ~~the encapsulating material and/or the support member~~, the interlocking feature being configured to engage with a corresponding interlocking feature of another microelectronic substrate package.

18. (Amended) The method of claim 17 wherein manipulating a portion of the ~~encapsulating material and/or the support member~~ includes directing laser radiation toward ~~the encapsulating material and/or the support member~~ to ablate the portion of ~~the encapsulating material and/or the support member~~.

20. (Amended) The method of claim 17 wherein processing the ~~encapsulating material~~ support member includes forming a recess in the ~~encapsulating material~~ support member.

22. (Amended) The method of claim 17 wherein the microelectronic substrate is electrically coupled to the support member and the interconnecting feature is a first feature formed in the ~~encapsulating material~~support member, and wherein the method further comprises processing the ~~support member~~encapsulating material to form a second interconnecting feature configured to engage the first interconnecting feature of another microelectronic substrate.